



# Military Radios Model Library

The Keysight Technologies suite of model libraries provide a large number of reusable models for network devices, protocols from all layers of the protocol stack, applications, and the communication environment. These models make it possible to easily create scenarios that can be used in the design and analysis of a large variety of communication networks and can be used with the QualNet and EXata simulation/emulation tools and with the Network Defense Trainer.

QualNet/EXata scenarios can also be used in a federated environment using the High Level Architecture (HLA), Distributed Interactive Simulation (DIS), or IP sockets to run co-operative simulations with other simulators to provide more realistic and meaningful results.

## The Keysight Technologies Military Radios Model Library Consists of the Following Models:

MODEL NAME	MODEL TYPE
Compact Terrain Database (CTDB) interface	Terrain
FCSC radio prototype	Physical and MAC layers
Link 11 protocol	MAC layer
Link 16 protocol	MAC layer
Multi-Generator (MGEN) toolset	Application
Multi-purpose traffic generator	Application
Threaded application	Application

## Link 16

Link 16 is a frequency-hopping, jam-resistant, high-capacity tactical data link used by the United States Navy, the Joint Services, and the armed forces of some nations in NATO (North Atlantic Treaty Organization). Link 16 operates on the principle of Time Division Multiple Access (TDMA), where 128 time slots per second are allocated among participating Joint Tactical Information Distribution System (JTIDS) units. Time slots are organized into multiple functional Network Participating Groups (NPGs). Link 16 provides improved security; increased data rate (throughput); increased amounts/granularity of information exchange; reduced data terminal size, which allows installation in fighter and attack aircraft; digitized, jam-resistant, secure voice capability; relative navigation; and precise participant location and identification and increased numbers of participants.

Implemented features:

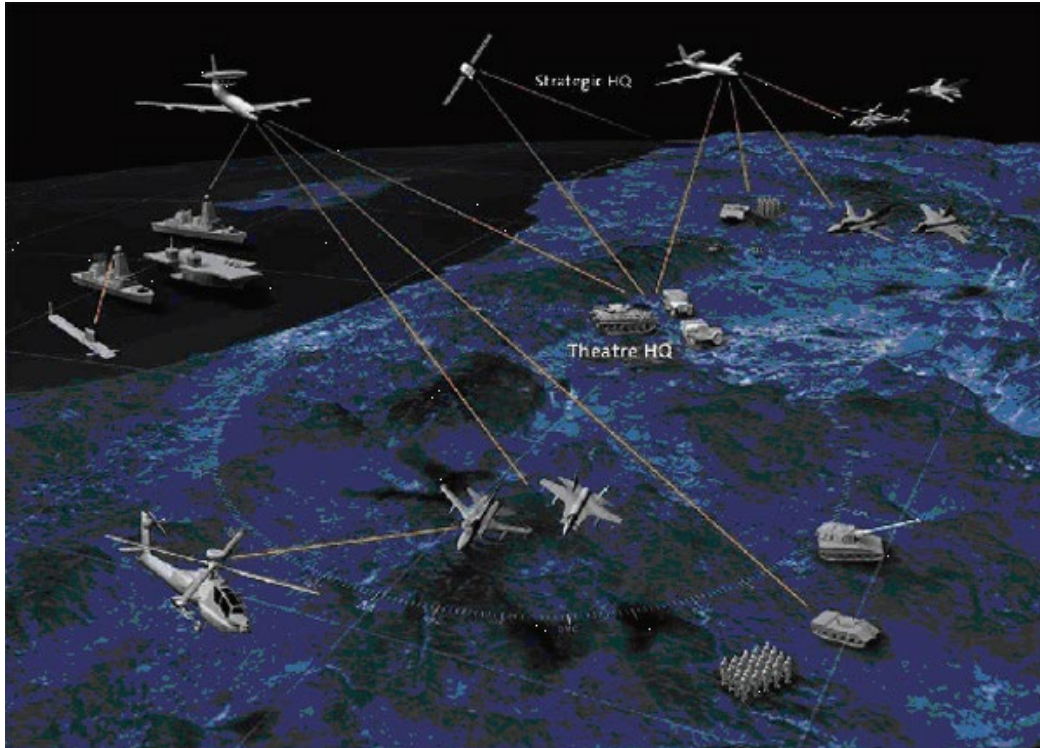
- Link 16/IP Gateway: a Link-16/IP gateway functions as an application layer proxy to connect Link-16 networks to IP networks
- Detailed TDMA settings, including slot/frame timing and slot assignment
- Single frequency transmission mode
- Range extension via relay
- Link 16 data word structure: initial word, extension word
- RS and CCK encoding
- Link 16 data packing structure: standard Double Pulse (DP), Packed-2 Single Pulse (P2SP), Packed-2 Double Pulse (P2DP), Packed-4 SP

## Link 11

TADIL-A/Link 11 is a half-duplex, netted, secure TADIL radio link for exchange of digital information among airborne, land-based, and ship-board tactical data systems. It is the primary means for exchanging data such as radar tracking information beyond line of sight. Link 11 can be used in either High Frequency (HF) or Ultra-High Frequency (UHF) bands. It provides gapless, omnidirectional coverage of up to 300 nautical miles in the HF band and approximately 25 nautical miles (ship-to-ship) or 150 nautical miles (ship-to-air) in the VHF band.

Link 11 is a centralized MAC protocol and relies on a single platform to report positional information on sensor detections. This positional information can be amplified with additional data to qualify the identity of the detected track. The set of nodes participating in a network, also known as Picket Units (PUs) operate with a centralized controller, called the Network Control Station (NCS). The NCS uses a polling (roll call) mechanism to gather information from the PUs, generates reports, and broadcasts the reports to the PUs.

The primary goal of the Link 11 model is to accurately implement the roll call mechanism and also accurately replicate the header additions and the control packet exchanges in the Link 11 protocol.



Implemented features:

- Identification of network participants or Picket Units (PUs)
- Identification of network control stations (NCSs)
- Roll call mode of operation
- Support for user configurable data rates

## Compact Terrain Database (CTDB) Interface

The Compact Terrain Database (CTDB) formats support high-performance access to elevation data, terrain features, and building data. These formats were first developed for the Modular Semi-Automated Forces (ModSAF) interactive entity-level force-on-force simulator. ModSAF was later transitioned to OneSAF Terrain Testbed (OTB). The Keysight Technologies CTDB interface supports CTDB Format 7 and Format 8 terrain files and extracts elevation data (height above the WGS84 ellipsoid) based on latitude/longitude coordinates.

## Multi-Generator (MGEN) Toolset

The MGEN toolset is an open source software package distributed by the United States Naval Research Laboratory (NRL) that enables performance tests and measurements on an IP network using the underlying UDP/TCP protocol. The MGEN application generates real-time traffic patterns allowing the network to be loaded in a variety of ways. Script files are used to drive the generated loading patterns as well as to control the receipt of MGEN packets. Log files can be used to record the received traffic for post-test analysis, such as calculation of throughput, packet loss rates, communication delays, etc.

## Multi-Purpose Traffic Generator (MPTG)

The Multi-Purpose Traffic Generator (MPTG) is a generic traffic generator that can work over the standard transport protocols, UDP and TCP, as well as by bypassing the TCP/IP protocol stack.

## Threaded Application

Threaded Application is a generic traffic generator that can simulate both UDP and TCP flows. Two-way flows (request-response) are supported for UDP based applications. The application can trigger other application flows based on the Scenario Description File (SDF) and Platform Definition File (PDEF).

## Future Combat Systems Communications (FCSC) Radio Prototype

The purpose of the FCSC prototype is to demonstrate the use of the FCS Comms Transceiver API, also known as the UDAAN Transceiver API, and illustrate the implementation of that API in QualNet and EXata.

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